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FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FOREST FIRE CONTROL

The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

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THE GREAT MINNESOTA FIRE

[The material for this article was extracted from a report prepared October 30, 1918, by John McClaren, who was at that time National Forest Examiner in Region 2, U. S. Forest Service. This factual account of a great catastrophe, viewed through the eyes of a man who well knew the horrors of fire, brings with it an appreciation for the advances made in the past 35 years in the field of fire control.—Ed.]

On October 12, 1918, I was in Duluth. The morning was bright and clear, but shortly before noon there was more or less smoke in the sky towards the west, which increased in volume throughout the day. By 2 p. m. the smoke had become rather dense in the city, and at 3 p. m. the sun was entirely obscured. I knew there were a great many small fires burning throughout the State to the west and began to get alarmed, but could obtain no definite information from any source regarding the location of fires until about 4 p.m. At 4:30 the sky had become so darkened that it was necessary to turn on the street lights.

I got into communication with City Fire Chief Rednall and learned from him that a number of serious brush fires were burning along the Pike Lake road and the Rice Lake road. Some of his men and a number of policemen had been detailed to fight the fires. He told me that the fire had come close to the outskirts of Duluth at Woodland, and a part of the fire department was put there to hold the fire back from the suburbs. At this time there was little apprehension that there was danger of loss of life or any very considerable amount of property. Very soon afterwards, however, many of the men began to return with stories of close calls in getting out of the region where fires were burning. They said many people had been brought in and that since the wind was rising there would probably be lives lost and considerable loss of property. Word was also brought in that several towns were burning or had been wiped out. I believed it advisable to notify State Forester Cox of the situation, giving what details I could gather. I subsequently learned that this was the only word received by the State Forester during Saturday of the impending disaster.

Near Panic in Duluth

By 7:30 p.m. the wind was very strong, and by 8 it had become a gale. Things looked exceedingly serious with regard to the safety of the city, and the Fire Chief was besieged with calls from residents asking his advice in regard to remaining in their homes. Because of the serious situation in the city proper, it became necessary for him to concentrate the efforts of his men and all the

apparatus in town in fire fighting and it became imperative that the men and apparatus in the suburbs of Woodland and Lakeside be withdrawn and brought back. Serious fires occurred at the Canadian Northern Lumber Docks, in the Alger Smith Lumber Yards, and the Woodruff Lumber Yards were consumed, wiping out the Duluth end of the Interstate Bridge. Many other small fires occurred as well. No serious damage was done the city property, with the exception of the larger fires noted, and by 2 a.m. Sunday morning, things began to quiet down.

Home Guards and Motor Corps Mobilized

Early in the evening when it became evident that a disaster of large proportions impended, these two organizations were mobilized at the armory, and every machine in the city was pressed into service. Thousands of people were saved who otherwise would have perished. Detachments of the Home Guards were sent to Woodland and Lakeside to assist in rescue work; others were detailed to secure bedding, cots, etc., to be placed in the armory and other public buildings for refugees who were being brought in by automobile and train. The Red Cross turned out in full force and did a wonderful work in helping to care for the injured and making comfortable thousands who arrived in the city homeless and penniless.

Speed limits were abolished and it seemed to me that every machine in the city was making all the speed that the capacity of the engine offered. Naturally there were many narrow escapes, but I believe that none of the rescuers were seriously injured. In view of the crowded conditions on the roads and the terrible speed with which the machines traveled, this seemed a miracle.

Refugee Trains Arrive

By midnight, communication with the outside by telephone and telegraph was practically an impossibility; it was my understanding that only one wire was working, that towards Minneapolis. The wildest sort of rumors were frequent with regard to what was happening on the outside, and since many of the stories seemed exaggerated, it was hard to know what to believe. A town would be reported burning, or burned, and within 10 minutes a counter rumor would be to the effect that it had not been touched. The trains began to get in, however, about 2 a.m., and it was learned that the disaster was so awful that few of the reports we had received were exaggerated.

Brookston had burned about 2:30 in the afternoon, and the fire had reached Cloquet by 7. All the people in these towns were saved by relief trains that brought them to Superior and Duluth. Here again the wonderful efficiency and promptness with which the Home Guards and Red Cross workers had acted was apparent. Doctors and nurses were on hand at the depot, as well as Red Cross assistants. Many of the scenes were pitiful in the extreme. The sick and injured were carefully handled, the majority of the cases being rapidly transported to the hospitals which were soon

filled. Some of the people who came from the towns carried with them suitcases, all that they had been able to save. These people were well dressed as a rule, but many others were coatless and hatless, and the terror of the experiences through which they had passed was clearly marked on their faces. Some of those who had been brought in from the rural districts had been able to gather a few belongings in a bed quilt, but many had saved absolutely nothing.

Rescue and Relief Work

I reported at the armory at 7 a.m. Sunday, October 13, and found Captain Bergen in charge. Regardless of the fact that every automobile and truck had been in service almost continuously during the night, I found hundreds of them parked in the vicinity of the armory, and the drivers were ready for assignment to the work at hand. Passenger cars were to be sent in every direction to bring in any of the living who were in dire straits, and to carry food and clothing to others who were in need but were sheltered in such buildings as had escaped the fire. Trucks were assigned definite routes to search for and recover bodies of those who had lost their lives. I was a member of a party which was to go out the Pike Lake road. The truck that preceded us had removed the bodies of those who had perished along the highway. Arriving at Pike Lake we found help was needed in recovering seven bodies of persons who had drowned in attempting to escape a death by fire.

Charles A. Marshall, who was manager of the Lyceum Theatre in Duluth, owned a summer cottage on the shore of Pike Lake. He, with his wife and little boy, was spending Saturday at the cottage, and had as guests Mr. and Mrs. Walsh and two daughters, and Mr. and Mrs. Frizeou and their 12-year-old son. They became alarmed late in the afternoon and decided to go back to Duluth. They traveled but a short distance, however, when they found that the road was shut off by fire and returned to the cottage. It was evident that all the property along the shore was doomed, and that the only chance to escape seemed to be by boat. As nearly as I could learn, this was at about 8 o'clock and the night was exceedingly dark.

A hurried search revealed two small row boats, but only one pair of oars. Accordingly, the women and children with Mr. Marshall took the boat for which the oars were available and started across the lake. Mr. Walsh and Mr. Frizeou used the other boat, with pieces of boards for paddles, and ultimately crossed the lake to safety.

Sometime later Mrs. Frizeou joined them, having been the only survivor of her party. Her story, as I heard it from the others, was that the boat capsized shortly after it was launched. It seems incredible that she was able to cling to the boat until it drifted across the lake and at the same time drag Marshall by the collar until shortly before she was near shore. During the day we recovered the bodies of Mrs. Marshall and her little boy. Examination of the boat they used revealed a hole in the bottom about the size of a quarter; it was hidden by a strip directly above it.

General Scenes of Devastation

Pike Lake is about 16 miles from Duluth and is reached by traversing what is known as the Miller Trunk road. I was somewhat surprised to note that very few fires were burning in the area. Apparently the disaster had ended with a swift onrush of flame almost as suddenly as it began. Freakish instances were noted, as is often the case where a large fire sweeps over a country accompanied by a very high wind. Many farmsteads were completely wiped out, others escaped injury altogether; in other places a part of the improvements remained, though one could not determine how it was possible for any part to escape where they were seemingly in the direct path of the blaze.

One of the sad features noted on the trip to Pike Lake was the great number of automobiles that had been destroyed. These were owned by people who had attempted to get away from the fire danger and into Duluth. In some cases the occupants of the cars had made their escape, but others were not so fortunate. Realizing that the smoke was so dense in the city of Duluth on the afternoon of October 12, it was not at all hard to conceive that the drivers of vehicles had great difficulty in following even as good a road as the highway between Duluth and Pike Lake. Some of the machines were badly wrecked though others apparently had suffered but little damage before the fire reached them.

Cloquet

Arriving at County Road Engineer Ackton's office on the morning of the 15th, I was informed that arrangements were being made to send Surveyor Anderson out in the vicinity of Brookston, in a car to gather data with regard to the need for repairs to roads in that vicinity, that Anderson would be fully occupied thus, and that he wished to assign me to the work of taking a stock census in the vicinity of Brevator, Brookston, and Paupores, and that he had arranged for Mr. Dixon, a veterinary surgeon, to go along since it was probable that burned cattle would be found which could be saved by treatment.

En route, we came to what had been the town of Cloquet, with a population of 9,000 people. I had visited Cloquet just a week previously to confer with State Ranger Vibert on Weeks Law inspection work. The devastation wrought here was beyond description. Many of the buildings were of cement and brick, but the town was practically razed. Being told that our car was standing on what had been the depot platform, I could not realize the location of the hotel which was just diagonally across the square.

The residents of the town owe their safety in a large measure to the action taken by State Ranger Vibert, who recognized the danger to the town early in the afternoon. Through his efforts, the Great Northern held in readiness four long trains at the depot. Toward evening it was evident that the town was doomed, and the people rapidly entrained. Several thousand escaped to Carleton by automobiles, but had it not been for the fact that the trains were in readiness, the loss of life would have reached an enormous figure.

Professor Wentling of the State University and his wife, and Mr. Kenety with his family, arrived at Cloquet late in the afternoon from the Forest Experiment Station and were among the refugees who escaped by train. From Mr. Wentling I learned many of the details of the trip, and while space forbids an attempt to repeat much that would be of interest, the following briefly covers it:

Vibert had had patrols out in various directions during the afternoon, with whom he kept in close contact; when he decided that the town would go, the fire siren was sounded for the first time in 15 years, and all the bells and whistles in town gave warning. In addition, Vibert went from place to place and any individual who showed a disposition not to heed the warning was briefly told to get out. The people began streaming towards the depot, some carrying suitcases, some with musical instruments, and others with part of their belongings rolled up in blankets, etc.

The trains were made up of flatcars, boxcars, and gondolas. To Mr. Wentling's party fell the choice of a gondola in which remained about an inch of coal dust that had in some manner become wet. By this time the town had begun to burn and it was evident that apparently nothing would be saved, and yet the women particularly grouped themselves together and passed the time socially and in joking without showing evidence of the weight of the tragedy that was being enacted. In order to escape the force of the wind, it was necessary for the people to sit down in the gondolas. Their appearance upon arriving at their destination was marked to say the least.

As is well known, the lumber industry is the chief one in Cloquet. A considerable number of mills of large capacity, a toothpick factory, pulp mill, etc., were just to one side of the path of the flames and were not damaged, though the Northern Lumber Yards were cleaned up, including about 125 million feet of lumber. The wind was blowing a hard gale from the northwest to the southeast. So hard in fact that the flames in all the area burned did not spread laterally while the high wind continued. This is apparently the reason why the mills and most of the lumberyards escaped destruction.

Continuing on our way from Cloquet we overtook a man along the road, gave him a lift, and stopped where he asked to get off. Looking around we could see that every building, all fences and machinery, as well as haystacks, had been consumed. Questioning him we learned that he had saved his wife and eight children in a waterhole and that his family and another had taken refuge in a shack about a mile off the road; they were in rags and had eaten their last mouthful. We gave him some sandwiches and apples we had brought for our own use, and promised to try to get relief for them the next day. Arriving at Brookston, Sergeant Miller immediately scraped together food enough to tide them over a few days and said if we could pilot a relief car back, they would get to them that night. This was done. The youngsters were measured and clothes delivered to them today. The relieved ten-

sion of those 4 parents and the unbounded joy of those 11 kids would strike the heart of a stone man.

The greater percentage of stock not confined in barns when the fire swept across the country escaped alive, and many escaped injury altogether. On the other hand, there were a great number of cattle that needed treatment for burned udders and hoofs. Dr. Dixon had with him a 2-gallon jug of carron oil in addition to other drugs and medicines and this entire amount was used and distributed during October 15 and 16. The forethought in sending out such men cannot be too greatly appreciated. We found very few instances where the burns were so severe that it was deemed necessary to kill the animals. Because of treatment, hundreds of cows will become normal within a short time. Had they not been treated, the loss in money value would have been great since practically all of the stock kept in this section by settlers is milk stock.

A surprising thing that we noted not only in this region but throughout the burned territory was that the horses not killed by the fire escaped entirely unharmed. I presume this is due to the fact that they are much fleeter of foot than cattle, and yet it seems miraculous that some were not injured by fire and that more of them were not killed outright either by the flames or from suffocation.

Upon returning to Duluth and reporting to Mr. Ackton the result of the field investigation, I learned from the newspaper that the fires were still serious in the vicinity of Moose Lake and that State Forester Cox had established headquarters there.

Moose Lake

Arriving at Moose Lake, I found that Mr. Cox had left the evening before in order to make a tour of the various burned districts. This area was under martial law and the Home and National Guards were being used for fire fighting in addition to the rescue and relief work. My services were not needed, and having an opportunity to make a trip over the area with Major Histed and Captain Cary, I availed myself of the chance. We were armed since there were many wild rumors of incendiarism particularly in regard to a closed Packard car in which were said to be two men in Home Guard uniform, fully armed, who were known to have been setting fires in various parts of the district. Whether there was any truth in the rumor, I am not prepared to say, but little credence should be given the incendiary theory. Conditions in the vicinity of Moose Lake were worse so far as loss of life went than in any other part of the State, and many of the scenes encountered were but duplicates of those found in other burned areas.

Cass Lake

Supervisor Marshall had been engaged with a few of his men in combating a small fire on the national forest on October 12 and did not realize that a serious fire was raging near town until to-

wards evening when he returned. At this time, he learned that a number of settlers had been burned out, refugees had been brought into Cass Lake, and that the town had been seriously threatened. Fire fighters had been very hard to obtain because of the extraordinary high wages in other lines of work. Fortunately, Marshall was a Major of the Home Guards, and after reports began to get into St. Paul, Adjutant General Rhino called Marshall and instructed him to mobilize the Home Guard and clothed him with full power to take any action he saw fit.

Had it not been for the power vested in Marshall, it is possible that the nursery and a part of the Minnesota National Forest would have been wiped out because some excitable and panicky persons had decided that the only way to save Cass Lake would be to start a backfire in the vicinity of the nursery. These persons were restrained by the cooler heads until Marshall was again in town and issued orders that backfiring was by no means to be resorted to unless he ordered it.

Superior National Forest

Early in the week before leaving Duluth, I had been unable to get word to Ely by wire. Rumors were thick to the effect that serious fires had occurred along the North Shore and that the Alger-Smith railroad had been put out of commission by fire. Arriving at Ely, I was very much gratified to learn that the rumors were groundless and that the forest had been untouched by the series of fires which ran on October 12.

Cause of Fire

Fortunately I had covered practically all of the State where the big fires occurred during the preceding 30 days and was therefore in a position to analyze the cause of the disaster much better than would otherwise have been the case. The full extent of the area burned had not yet been learned when I left the State. It will take quite a time to traverse and map the fires. At first, it was the general impression that all the loss of life and property occurred in one big fire. This was erroneous. There were at least six large distinct strips burned over, each without reference or connection with another.

On March 16 the Minnesota Commission of Public Safety had issued an official order addressed to settlers, campers, construction crews, and all citizens that from and after April 15th, for a period of 6 months, no fires were to be kindled or set in grass, stubble, peat, brush, slash, or woods. It is probable that the disaster would not have occurred had there been a field organization of sufficient size to enforce this order. With something near a million acres to a man to supervise, it is not hard to understand that many fires were set unknown to the rangers.

The railroads in some instances were criminally negligent, as I had occasion to know from personal observation. Along one line, fires had burned so far across the country that the outer limits

could not be estimated. Thousands of acres in this vicinity had been burned clean, including a light layer of peat that had existed on top of white sand. I remarked to the conductor that a serious situation apparently existed, but he replied indifferently that such fires were common every year, and that every year fires were frequent all along the line from Duluth.

The region that was fireswept has a normal precipitation of from 14 to 20 inches. This year only about 4 inches had fallen. Realizing the vast number of fires that existed in this part of the State, and the extreme dryness, it does not take any profound reasoning to determine that all that was necessary to accomplish the devastation that occurred on October 12 was a high wind.

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Canteen Spray Pump

A lightning fire or any fire in an area where water is scarce has always been a problem. Some times a gallon or so of drinking water is available but to get the right amount of water to the right place has always meant the difference between getting the fire out promptly or having to dig it out.

Any fire fighter can cite the methods that are used, squirting by mouth, dribbling water from canteen through the fingers, etc., and at times we have carried an Indian pump and pumped water from a canteen. The regular pump, however, adds weight to the pack on a long trip, doesn't fit well in a pack, the hose is too stiff and large, in fact most men would leave it behind the first log along the trail.

We believe we have found an answer to the problem—a commercially manufactured miniature pump. The pump is made of heavy brass tubing, ½ inch outside diameter. The total length of the pump is 17 inches and it has a double acting plunger. It has an adjustable nozzle ranging from a fine spray to a straight stream. The working parts are very simple and appear to be foolproof. The hose is rubber or Neoprene, but should be about 12 inches longer than the 33-inch hose that is furnished. This pump could be purchased without hose, or we could specify the length of hose wanted.

The pump was tried at the joint Six Rivers-Klamath Guard School on an actual fire and many other tests have been made. Using a 1-gallon canteen for a tank and pumping steadily, it took 9 minutes with the solid stream and 15 minutes with the spray adjustment to empty the canteen. The solid stream will reach out 25 feet without too much effort. The spray covers a wide area on fine adjustment and the coarser it is the narrower its spread becomes. The pump and hose are light, weighing only 8 ounces with 36 inches of hose. The cost of pump, hose spring, and Neoprene bushing is about $2.50.

Everyone seeing or using the pump has been impressed with its possibilities, not only on small isolated 1-log fires, but on the mopup job on any size fire.—LYLE W. HILL, *Klamath National Forest.*

A PORTABLE POWER BRUSH AND WEED CUTTER

ARCADIA EQUIPMENT DEVELOPMENT CENTER

U. S. Forest Service

A power saw for cutting brush has been an object of widespread search for years. Private companies as well as the Forest Service have designed saws for this purpose, using as a general rule a circular blade. Saws so designed, while performing satisfactorily on single firm stems, seldom operate efficiently in dense stands of brush.

Recently one manufacturing company, having designed a portable power weed cutter with a demountable head, attached a head equipped with a chain saw. After considerable field testing and redesigning, a sturdy dependable power saw for cutting brush was developed. (fig. 1).

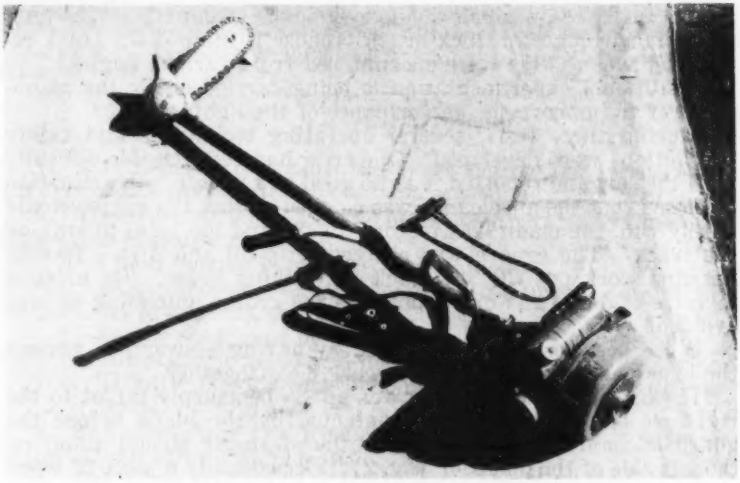

FIGURE 1.—Portable brush cutter with chain-saw head.

One of these power brush cutters, along with a power weed cutter, was sent to the Arcadia Equipment Development Center for testing and demonstrating.

The brush cutter was a portable power saw weighing 28 pounds, which could be carried by means of a shoulder sling.

The engine was a 2-cycle, air-cooled, rope-start unit rated at 2 hp. at 4,000 r. p. m. The fuel tank was 1-quart capacity.

The cutting head consisted of a 12-inch grooved blade on which a 32-inch chain saw ran. This saw was driven by a shaft inside the tube connecting the head and engine. Between the shaft and engine was an automatic centrifugal clutch, which allowed the saw to remain stationary when the engine idled. A convenient throttle control placed on the handle could be operated by the thumb.

This brush cutter was demonstrated on numerous forests in the western regions, and met with approval. Since it was so light in weight, there was some doubt as to its ability to stand up. So, it was subjected to an endurance test consisting of 100 hours of operation on various jobs on the Angeles and San Bernardino Forests. One road crew of 3 men was able to double the amount of work done each day. At the end of 100 hours, the unit was still operating efficiently, with no mechanical difficulties during this period. Material up to 8 inches in diameter was cut.

Various types of chain saws were used in the test in order to determine the one best suited for cutting brush. Contrary to expectations, the chain saw having a cutter tooth to each link was inferior to those having a cutter tooth to every other link. More effort was needed to force the saw through material, and it had to be sharpened more often. Naturally, it took longer to sharpen.

A narrow saw which was more efficient in cutting large stems proved inadequate in thick brush because it jumped the track repeatedly when twigs were encountered from various angles.

Additional experimentation is being carried on by the manufacturer to improve the performance of the lighter chains.

During these tests, several operating techniques and safety precautions were developed. One crew had considerable difficulty with the saw and reported it as no good and unsafe. Examination disclosed that the air cleaner was clogged so that the engine would barely run, the chain was too dull to cut and too loose to stay on the track. The groove was clogged with oil and dirt. Twenty minutes work put the saw back in working order. By using a mixture of diesel and oil to lubricate the groove, gumming-up was avoided.

Since best results are obtained by having a swamper remove the brush as it is cut, two men work close together.

It was found that the saw was apt to be sharply thrust to the right as small branches are contacted by the blade before the guard encounters resistance. So the swamper should stand on the left side of the operator (fig. 2). Occasionally a piece of wood wedges into the guard over the sprocket gear which runs the saw. Even if the engine is idled, it is unsafe to unlodge the material by hand. A screwdriver and small pair of pliers are very handy for this purpose; even then, the engine should be stopped for absolute safety.

The portable weed cutter was likewise run for 100 hours in an area containing a variety of weeds, some of which had woody stems up to one-half inch in diameter. This unit performed very satisfactorily during the test, and the work output was beyond all expectations. The fatigue factor was very low for the results obtained.

FIGURE 2.—Swamper should always stand on operator's left away from thrust of saw.

CONCLUSIONS

1. It is believed that both the brush cutter and weed cutter are dependable and efficient tools for many forestry activities.

2. The brush cutter will perform for long periods of time with little or no difficulty if:

   a. Chain tension is properly maintained.
   b. Chain groove is oiled frequently (mixture of oil and diesel preferred).
   c. Saw is sharpened periodically.
   d. Air strainer is cleaned daily.
   e. Throttle is wide open when saw is in contact with material.

3. The wide chain saw with teeth every other link is superior to the various other chains tested.

4. The narrow chain saw tested cut faster but will not stay on the track when cutting brush with branches at various angles.

5. By loosening two bolts and replacing the saw head with the sickle bar head, the brush cutter becomes a weed cutter with a minimum of effort.

6. This combination unit appears as a worthwhile addition to the family of tools commonly used in forest activities, particularly if final development shows the lighter and narrower saw chain to be practical.

STRIP CUTTING IN DENSE PINE STANDS ON OSCEOLA NATIONAL FOREST

GEORGE K. SCHAEFFER

District Ranger, Osceola National Forest

Development of mechanized fire fighting equipment in the Southern pine belt has ordinarily progressed from light plows pulled by jeeps, power wagons, or light tractors to ever heavier and more expensive tractors, equipment, and transports. This development is the natural result of a successful fire control program, which made possible the establishment of dense, even-aged stands of pine over wide areas. In early fire fighting days, these young pines were easily ridden down by pickups, then by power wagons, later by light tractors, then heavy tractors. But now that many of these dense stands are approaching merchantable pulpwood size, it has become much more difficult to push even our heaviest tractors through them. After 23 years of protection on the Osceola National Forest, a large percentage of the stands of slash pine are appproaching or have reached this critical stage.

Studies of fire equipment presently in use on this forest indicate a probable need for still heavier equipment for fire control work. Such heavier equipment would be most useful in the period just prior to and during the initial commercial thinnings; after that, present equipment would again serve adequately in the wider spaced stands. However, use of heavier equipment increases expense, reduces mobility, results in more stand damage, and is not essential if other means or methods can be applied to overcome the dense-stand handicap that is present at certain stages of pine stand development.

The Osceola, when purchased, was quite thoroughly cutover and had burned over annually. This resulted in elimination of reproduction on the dry ridges, but had permitted successful regeneration of the numerous scattered ponds,[1] which were usually sufficiently wet to stop the annual fires. Today, a typical compartment contains extensive ridge stands of saplings or small poles, and ponds with sawtimber stands in need of intermediate cutting.

Logging of the ponds involves skidding and hauling tree-length material through the intervening pole and sapling ridge stands to yarding and loading sites and on to the graded roads. Normally, skidding and hauling logs results in the scarring of leave trees and the extensive breakage of small stems, and involves expensive road cutting.

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[1] In Florida, "ponds" are low lying areas of productive timberland where water stands during certain seasons of the year.

On the Osceola, the problem is being solved by making commercial thinning sales on the ridges in advance of the pond logging. These thinning sales are unusual in that they call for the clear-cutting of parallel east and west strips 10 feet wide and 100 feet apart. The strips run to or between ponds but not into them. They are used as haul roads for the material clear cut and for the products of regular thinning practices on the intervening 100-foot strips. Where feeder roads do not exist, occasional north and south strips are cut although in most sale areas this need is met by existing woods trails and roads which usually need only widening and straightening.

The clear cutting of the east and west strips results in a conservative mechanical thinning by removal of about 9 percent of the stand by area. The 10-foot strips do not reduce the crown canopy any more than a normal thinning operation. Little of the material under pulpwood size is lost, since there is a good local market for fence stakes with a bottom diameter of 1½ to 3 inches. The clear cutting of 9 percent of a stand also makes possible commercial sales in an area not otherwise operable. It is in this type of stand, too big to plow through but too small to justify a regulation pulpwood thinning, that the operation shows the most decided benefits to fire control. Stands opened up in this manner will have their growing area reduced by 9 percent, but this will be offset at least in part by increased growth along the openings. The small stumps will rot out rapidly, thereby facilitating the subsequent hauling and plowing of control lines for prescribed burning or the control of wildfire.

A summary of the advantages of cleared strips follows:

1. Access for fire equipment, including pickups and jeeps, will be unimpeded. Attacks on wildfires will be facilitated.
2. Spotting of slow burning fires, or search for lightning sets will be easier because of long sighting distances down cleared strips.
3. Plowing of backfire lines for fire suppression and for prescribed burning will be simplified and the cost reduced.
4. Control of prescribed burning will be more easily accomplished during wind changes.
5. Use of lighter and therefore cheaper tractors and transports will be possible. Operating expense will be reduced proportionately.
6. Damage to timber to be retained for later cut will be greatly reduced.
7. A permanent system of access roads essential for intensive management of a forest property should result.

COOPERATIVE FOREST FIRE PROTECTION

W. J. STAHL

Assistant Chief, Division of Cooperative Forest Protection, Forest Service

From time to time we are asked for a brief explanation of the cooperative forest fire program as now carried on under authority of the Clarke-McNary Act of 1924. This statement is an effort to provide an understanding of a large program in a few words. It also may provide background for all who are a part of the program.

Problem.—More than three-fourths of our Nation's forest lands are in State and private ownership. In general these are the most productive and accessible forest lands. Nearly 90 percent of all our forest products come from them.

About 200,000 fires occur on these lands each year, burning about 15,000,000 acres. Ninety-eight percent of these fires are man-caused and can be prevented. Prevention and suppression of destructive fires are the first essential steps toward making and keeping these lands productive.

Legislation.—As early as 1911 the principle of extending Federal financial aid in forest fire protection to States was established with the enactment of the Weeks Law. This was in the recognition that all sections of the country are directly interested in the protection of a vital national resource regardless of its location.

The work under the Weeks Law was strengthened and broadened by the passage of the Clarke-McNary Act of 1924. The funds appropriated under this act are restricted to activities on non-Federal timberlands, potential timberlands, and certain non-forested critical watershed areas.

Objective.—The objective is to aid States in forest fire protection by providing financial aid, and such special services as are needed by the States in furthering their program.

Administration.—The States exercise direct supervision and administration of this program. The extent of Federal aid to the States should not be measured in terms of financial help alone; it is much more than that. The Clarke-McNary program is a mutually cooperative enterprise in which the States and the Federal Government work as partners to reduce forest fire losses. The Federal officials strive to help the State officials in all phases of the work from preliminary planning to fighting fires. It is the aim of the Clarke-McNary men through consultation with State forestry officials and through analysis and observation of their problems and accomplishments to offer constructive suggestions for strengthening fire control where needed. These men make pe-

riodic field trips to each State to keep currently informed as to conditions, and to determine that Federal funds are properly apportioned and wisely spent.

Allotments.—Federal funds are distributed to cooperating States through a formula which is agreed upon by the Executive Committee of the Association of State Foresters and Federal officials. Two basic factors are recognized, (1) cost of the total job of providing basic protection, and (2) State and private expenditures.

Financial Plans.—Annual plans are prepared to show how the funds, State, private, and Federal, are to be used in the program for the year. They are approved by State and Federal officials before funds are spent.

Reimbursement.—States spend their money first. Then, upon periodic submission of reimbursement vouchers, the Federal Government reimburses the State not to exceed one-half the total expenditures shown on the voucher, and certified by the State Forester, up to the full amount of the Federal allotment made available to the State. The Federal funds are not sufficient to provide a 50-percent reimbursement of all State and private expenditures, the F.Y. 1952 overall figure was about 25 percent.

Audits.—About once a year administrative and fiscal audits are made of the accounts of the State as they relate to the cooperative project. This is done to insure integrity of expenditures.

The Job.—In 1952 there were 43 States and Hawaii cooperating under the Clarke-McNary Act. Periodic studies are made to determine area in need of protection and the estimated annual cost. The last study showed that 426,694,000 acres should be protected at a probable cost of $48,250,000.

In 1952 the protected area of State and private lands, 368,692,000 acres, was more than six times as large as the unprotected area, 58,002,000 acres. Yet more than half of the burned acreage was on this unprotected land. Approximately $37,000,000 was spent for protection.

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Fishlake 5-Man Fire Tool Box

A 5-man fire tool box has been designed on the Fishlake National Forest and constructed during the past winter season by the local forest officers at Richfield, Utah.

It is a lightweight, compact box made of plywood, with pine spacers, and is 53 by 21 by 14½ inches. Its compartments were carefully sized for the several items of the outfit, and their arrangement lends itself to convenience and speed in removing and re-storing the various items. Although light in weight, the box is sufficiently rugged to take the hard use to which it will be subjected.

A detailed drawing of the Fishlake 5-man fire tool box is available from Regional Forester, Forest Service Building, Ogden, Utah.—ELBERT L. COX, *Forest Ranger, Fishlake National Forest.*

COLORED PLASTIC FILTERS FOR SIGNALING MIRRORS

CECIL S. WYNNE

Late District Ranger, Tahoe National Forest

During the two bad lightning-fire years of 1951 and 1952, it was discovered that lack of communication facilities presented a serious handicap. The district cache contained 5 handie-talkie portable sets, but these could not come near to filling the needs. It was common to have more than a dozen parties or individuals out during and after lightning storms. Lack of communication left both the district and forest dispatcher uninformed for too long intervals.

The answer to such a problem would seem to be simply more 2-way portables. However, it is not the whole answer, since there are many limiting factors. (1) Often during a heavy siege of lightning it is necessary to send a single fireman to a reported smoke. Any person is limited to the amount of gear and tools he can carry. Over rough country it is often impossible to add another 15 pounds to the pack. (2) Firemen and others often make attacks on fires on their own initiative, without having opportunity to secure radio communication. (3) Finances do not allow for every person to be equipped with radio.

During various meetings, including safety sessions, the problem was discussed and a solution sought. Fire Prevention Aid Robert P. Mason was given permission to construct and test a simple signaling device, utilizing as a basis the Emergency Signaling Mirror Type ESM/2. For several years this district, as well as others, has used the ESM/2 mirror with good results between ground parties and lookouts. Location of small fires in the heavy fir type forest has been facilitated by the use of both radio and the signaling mirror. It is a simple thing for a searching party to flash the nearest visible lookout. This establishes their exact location for the observer in the tower, and by radio he is able to direct them in the proper direction.

It was Mason's idea that the mirror plus a color code could be used without benefit of 2-way radio. Tests revealed that the colors red, blue, green, and clear could be distinguished easily at a distance of 12 air-line miles. Accordingly, sheets of 1/16-inch plastic were obtained in red, blue, and green. These were cut to the exact size of the mirror, 3 inches by 5 inches, and corners rounded to correspond. Then a 5/8-inch round hole was drilled in each plastic sheet in the exact center. This hole is the same size as the cross on the face of the mirror. Another 1/4-inch hole was drilled through the mirror and plastic in the lower left corner of

the working (instruction) side of the mirror, with the plastic held on the face side evenly. A 1/4-inch spring-clip post was used to hold the colored plates in position and allow any one color to be placed in position in front of the mirror face. The entire addition to a mirror costs about 50 cents and adds not more than 2 ounces to its weight. The device can be carried easily in an ordinary shirt pocket.

The original plan for the use of this signal was to have each color stand for a cardinal direction—clear, north; red, south, etc. Tests have proved that, without the aid of radio, anyone on an observation point can be of great aid in guiding a fire crew or search crew to the correct spot in heavy timber or brush. This is not an endorsement for return to the use of the heliograph, but a recommendation for the simple adaptation of a small, light tool currently in good use. Indeed, in some areas probably more use can be made of the color scheme by having various colors stand for a code for a message, since they do not have the discovery problem encountered on this district. Use of the mirror on the fireline on larger fires, ground to plane or 'copter, and rescue missions seems to have some merit.

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Inflammability of the Current Year's Logging Slash, by George R. Fahnestock. U. S. Forest Serv. No. Rocky Mt. Forest & Range Expt. Sta. Res. Note 124, 10 pp., illus. 1953.

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CONVERTED MOBILE RADIOS FOR SECONDARY TOWERS AND STANDBY CABINS

ED. KERR

Press Representative, Louisiana Forestry Commission

Communications Engineer Al Vendt of the Louisiana Forestry Commission hates to see anything go to waste. Not even a radio tube is classed as a small item to Vendt, so one can imagine how he felt every time he had to junk a $585 mobile radio set. He set to work a few months ago to solve this problem.

Vendt's solution not only solved the problem of junked mobile equipment but also solved, in part, the problem of how to obtain more base station sets cheaply. Fixed station sets were badly needed in secondary towers and in standby cabins but the Commission didn't have the necessary funds (they cost about $800 apiece). Vendt converted a mobile set, which was no longer serviceable as such because of necessarily rough treatment in the field, into a base station set for about $60, including cost of the wooden cabinet built to house it (fig. 1). Most of the parts in the junked

FIGURE 1.—Cabinet, showing general arrangement of equipment.

set were good enough, Vendt said, to serve at a fixed station, although they were not dependable when bounced around in a truck or automobile. He estimates that the converted set will last at least 3 years.

The two most important items salvaged by this operation are the receiver vibrator transformer and the transmitter dynamotor, both of which are in short supply. They were found to be in good operation on the junked mobile sets, so they were taken out and put aside as replacements.

The changeover to a base station set consisted of converting the old mobile unit from 6-volt d. c. to 110-volt a. c. Because the equipment was so old, it was necessary to incorporate a peak modulation control circuit in order to meet the latest FCC requirements. Other than that, the only real problem was power supply to operate the control relays of the fixed station. Vendt found it to be more economical to use a 10-volt filament transformer and rectifier disk to replace the 6-volt d. c. supply than to change the relays to a. c. Costs of new parts totaled only $50. The cabinet, standing 3 feet high, cost $10 to build in the Commission carpenter shop. The entire unit is assembled so that it is easily accessible for repair, with the front hinged and joined by snap fasteners for ease of tube replacement and testing. The Commission now has 6 converted sets in operation. The first set was completed last fall and given its first test at a meeting of the Louisiana Forestry Commission Board.

The importance of such ingenuity cannot be measured solely on the dollars-and-cents saving on radio equipment. Like any other State agency, the Louisiana Forestry Commission has limited funds and cannot afford as many radios in the field as it needs. The six sets now in towers and standby cabins will save untold minutes in fire-reporting time not possible otherwise. This will mean forest acreage saved.

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Nylon Hairline for Staff Compass

While detailed to Forest Survey in Massachusetts, I had occasion to repair the hairline on the front sight of our Forest Service staff compass. Not having any horsehair or thin wire, I substituted 4-pound test clear nylon fishing leader. To my surprise, the semitransparent nylon was more helpful for sighting than horsehair.

In running cruise lines or preliminary survey lines where line cutting is done to a limited extent, or not at all, a dark hairline is sometimes confused with small saplings on long shots. This can become a serious source of error. Likewise, in a heavily shaded forest a dark hairline becomes indistinct. Clear nylon, being somewhat transparent, admits light, remains visible, and forms a contrast unlike anything else in the line of sight. Hence, the compass can be alined more readily and accurately. Furthermore, nylon fishing leader is not easily broken, and it remains rigid in all kinds of weather. I am now using 10-pound test nylon leader and find it very helpful for sighting.—(Work Improvement Proposal submitted July 13, 1953) STANLEY M. FILIP, *Forester, Northeastern Forest Experiment Station.*

FIRE DISPATCHING BY USE OF RADIO SELECTIVE CALLING

JOHN H. ATKINSON

Assistant Supervisor of Communications, Santa Clara County, Calif.

With the ever-increasing installation of radio in fire stations, lookouts, ranger stations, and in mobile units, new methods of dispatching are developing. One outstanding new feature is the dispatching of crews by radio at any time, day or night, without continuous monitoring of the radio circuit at the outlying points. Selective-calling equipment is necessary to accomplish this, and it can be installed as a part of any radio system.

Selective calling consists of a series of tones or pulses transmitted over a station's radio. Decoder units are attached to the various radio receivers. These decoders are selective to only one signal and reject all others. In such a manner the decoder reacts only when the signal for its station is received and will actuate a relay closing it for a certain period of time. Any number of sounding devices can be attached to the relay such as horns, bells, or buzzers to summon someone to the radio.

When the central dispatcher receives a report of a fire he sets up the proper combination on his selector and turns on his transmitter. In the called station a bell or other sounding device will be actuated, and the person who answers need only state the station name over the radio to signify that he is ready to copy the detail. This whole process takes less than 15 seconds. Where the station has only a receiver, it uses its truck radio transmitter to answer when it is summoned. Land-line dispatching and extensive toll calls are eliminated by using such a system, and sleeping crews can be alerted at night just as fast as during the day.

Selective calling can also be installed in mobile units so that the dispatcher can blow the horn or siren on equipment at the scene of fires when drivers are away from the radios. This will materially cut down radio traffic by reducing the amount of prolonged calling in attempts to contact units at the scene of fires.

Most selective-calling systems from a central dispatcher can have up to 1,400 different signal combinations and can be arranged for individual call of 1,400 points or by both individual and group calling of all lookouts, all units in a certain ranger district, etc., within the system.

One further development is selective calling from mobile units and small outlying stations to one central point. This makes it possible for them to signal the central dispatcher at night should they receive a local fire report.

Santa Clara County is presently dispatching all fire equipment by radio, using a system similar to the one described above. The radio system operates in the 152-174 mc. radio band with the central dispatcher at the County Fire Control Center being able to transmit alarms by radio to any of the 9 outlying stations or 40 mobiles. During the fire season nearly 300 alarms a month are transmitted by this means and have resulted in increased efficiency of operations and decreased getaway time.

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How Much Do You Know About the Jeep?

Most jeep accidents are due to a complete misunderstanding of the pecularities of this vehicle. The jeep was designed for a specific purpose—travel over rough terrain. It is used too often in lieu of the sedan type vehicle. How much do you know about the jeep?. For instance, do you know:

a. That a jeep has a *higher* center of gravity than the conventional vehicle?

b. That a jeep is 10 inches *narrower* than the conventional vehicle?

c. That a jeep has little springing action and that road shock causes the jeep to bounce off the ground?

d. That a combination of "a", "b", and "c" tends to make the jeep the easiest car there is to overturn?

e. That the steering mechanism of a jeep is such as to exert a cramping action in turning rather than a smooth turning action, as in the conventional car?

f. That the steering suspension is such as to result in a locking action when the brakes are applied?

g. That a combination of "e" and "f" tends to make a jeep harder to keep going in a straight line and more difficult to steer generally?

h. That "All-Weather" treads on a jeep or *any* car increase the *braking distance* on wet road surfaces over 38 percent (as compared to the conventional military nondirectional tread type)?

i. That a jeep was designed for a specific purpose: travel over rough terrain; that it was not designed for high speed; therefore, as the speed of this vehicle increases, its roadability decreases, and speeds over 40 m.p.h. are dangerous?

j. That the jeep lacks body protection; and that when it does upset it affords no protection from maiming, crushing injuries to the occupants.

k. That the jeep is so constructed that you do not sit *in it* as you do in a conventional car, lowering the center of gravity, you sit *on it*, thus raising the center of gravity; and that any weight over four persons raises the center of gravity to a dangerous high?

1. That a jeep has a 4-wheel-drive hook-up; and that the use of this drive on the straightaway increases the incidence of upset should the jeep run off the road onto loose gravel or sand?—*"Portlights," Maritime Administration.*

FM PACKSET AS A PORTABLE MOBILE UNIT

L. F. HAMILTON

District Ranger, Santa Fe National Forest

[This general approach to the problem of temporarily securing whip antennas to a vehicle roof has been published elsewhere. Our readers, however, may find it of value. We have seen nothing similar to the novel method of securing the radio to the seat.—Ed.]

In order to satisfy the need for a two-way radio that could be quickly switched from one vehicle to another, Gordon Sutton of the Region 3 radio division designed a portable antenna to go with the FM packset. A regular vehicle type spring-based antenna was mounted on a pressed board and aluminum base 12 inches square, This base is attached to the top of the cab by 4 vacuum cups (fig. 1, *left*). It is also fastened to the gutter over the doors by adjustable web belts and hooks.

A lead-in wire, fitted with a coupling of the same style as the one on the telescopic antenna that comes with the packset, can be passed through the car window and connected to the set. For regular use in a vehicle, a coaxial cable coupling can be placed through the wall of the cab and a short section of wire run from the coupling to the set. The lead-in wire from the antenna can then be connected from the outside of the cab and does not interfere with closing the door window.

The set is placed on the seat beside the driver. In order to meet safety requirements, the set should be fastened in place. The straps of the regular canvas carrying case can be fastened to the iron pipe frame above the back of the seat. This prevents the set from being thrown out of the seat, but permits the set to move sideways in the seat, which is annoying to the driver. Then too, the standard case, when strapped to the back of the seat, does not allow easy access to the radio for operation of the set within the cab.

I prepared a canvas case for the purpose of making the set accessible yet rigidly fastened in the seat. This case is open so that the operating parts of the set are accessible. An 8-inch flap is sewed along the bottom edge of one side of the case (fig. 1, *right*). The flap fits between the cushions and keeps the set from moving about in the seat. The free edge of the flap has a pocket for a rope or dowel to be used in case the cushions don't fit tight. This holds the flap securely in place.

The bottom of the case has a pocket for a piece of sponge rubber in case the set is to be carried some place other than in the seat.

The top edges of both sides of the case are reinforced with wood slats. The strap rings are fastened by short loops riveted through the case and slats. This keeps the straps properly spaced.

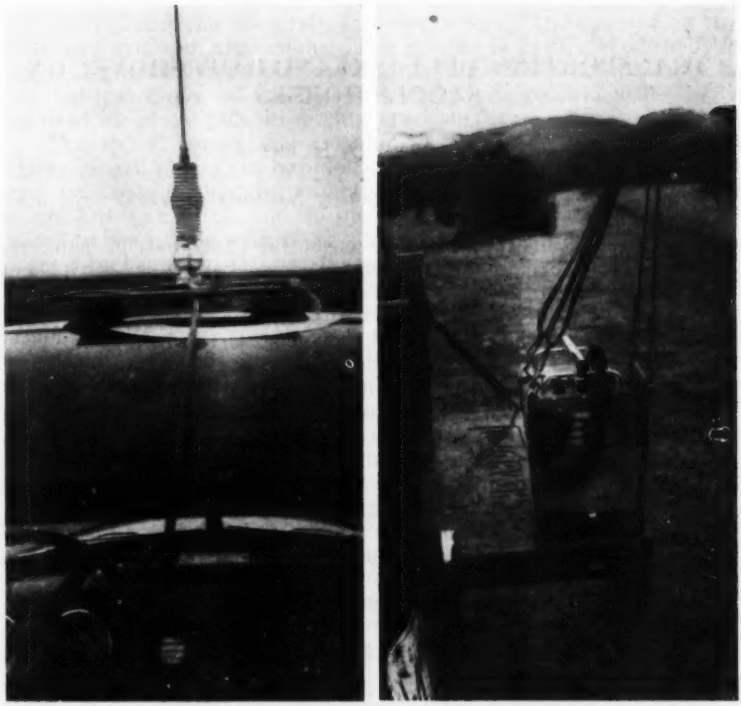

FIGURE 1.—*Left*, antenna on pressed board and aluminum base that can be quickly transferred from top of pickup cab to another vehicle. *Right*, Open case with set, showing flap at lower right edge, reinforcing slats, and strap rings.

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Radar Determines Fire Location

A fire call was received by the regional dispatcher's desk at 1:25 p.m. September 15. The unusual thing about this call was that the "fix" or location of the fire was determined by radar. An Army pilot located the fire and reported it to the radar control tower. The officer at the tower instructed the pilot to fly to the fire and signal when he was directly over it. Radar platted the position of the plane at the instant the signal was given. This location was then transferred to a regular map for a description of location by landmark. Where was the fire? About 10 miles east of White Salmon, Wash.—*N. W. Forest Service News* 589, Sept. 16, 1953.

TRANSPORTING A PULASKI AND BABY SHOVEL ON SADDLE HORSES

WILLIAM D. HURST

Forest Supervisor, Ashley National Forest

During the fire season it is essential that district rangers, forest guards, foremen, and other forest workers carry with them basic fire tools on their frequent horseback trips over their areas. The transportation of these tools on a saddle horse, if not properly done, is extremely awkward and most certainly unsafe. Too often these tools are not carried because of this and because of the discomfort to the rider. The following practical method of carrying a baby shovel and pulaski on a saddle horse is suggested.

If both pulaski and shovel are to be transported, two rifle scabbards 36 inches long are required. One scabbard is placed on each side of the saddle, opening to the rear and tied securely to the rear saddle skirts with the rear saddle strings. The fender and stirrup leather holds the fore part of the scabbards in place, and the front saddle strings can be used to adjust the scabbard in relation to the rider's legs. The essential feature in scabbard placement is to make certain the scabbard mouth is secured high on the rear saddle skirt. Many riders prefer to equip their saddles and scabbards with snaps and rings to make the installations rapid and secure.

FIGURE 1.—Scabbard in place showing how shovel is carried. Shovel blade should always be equipped with a sheath or wrapped in old canvas.

The pulaski can be safely and comfortably transported in the scabbard without alterations. The handle is oval. With a little adjusting in scabbard position the handle will fit comfortably in the natural crook of the leg. For safety, a good sheath should be used on every pulaski during transportation.

The shovel handle, being round, is uncomfortable to carry in the scabbard unless the handle is altered to better fit the leg. This can be accomplished by inserting a spring steel shank 1 inch wide, 1/8 inch thick, and 30 inches long in the handle. It is secured to the handle with rivets and a 10-inch section cut out beginning 6 inches from the handle top. The shank should be at right angles and not parallel to the face of the spade. This not only gives strength to the shovel but permits the proper use in the scabbard. If good spring steel is used, the handle is rigid and serviceable. An old buggy spring makes an ideal shank.

Cost of placing the shank in a shovel is about $1.50 per shovel. Scabbards of the 36-inch length required sell for about $6 to $8 each.

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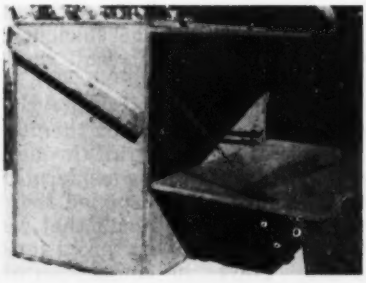
Klamath Pack Boxes

A well-organized pack trip is a pleasure. However, packing mess kits, grub, and the necessary essentials in open boxes is not only a chore but at times is frustrating. Supplies without good covers attract vermin no end, and within a short time the grub boxes are a sorry sight. After a few trips under these conditions, we built a set of grub pack boxes that makes setting up the cooking department more of a pleasure than a chore. We have one set that has been in use 11 years, averaging 8 trips a season, and another for 17 years and still going strong.



The boxes have tight covers that serve as shelves when open. In each box is a removable shelf kept in a slide in the top. This shelf can be used as a bread or meat board, or shelves from a set of boxes can be used across the box tops as a table. When supplies get low, these shelves can be placed in lower slides and towels or other filler used to prevent supplies from bouncing around.

Klamath pack boxes are large enough to take a regular 6-man mess outfit with 10-inch fry pans. Box sizes can be varied to suit the maker's needs. One variation has a grate compartment on the underside of the box. Detailed drawings and a materials list can be obtained from Forest Supervisor, Klamath National Forest, Yreka, Calif.—LYLE W. HILL, *Klamath National Forest.*

TELEPHONE LINE REDUCTION ON THE CUMBERLAND NATIONAL FOREST

S. W. CAMPBELL

District Ranger, Cumberland National Forest

The Sublimity Ranger District, one of the smaller districts within the Cumberland National Forest, once had a total of 140 circuit miles of Forest Service owned and maintained telephone lines. Most of the construction was completed during CCC days, when plenty of labor was available as well as money for employing supervisory personnel trained in telephone line construction. The result was a high class system, constructed on poles of brush-creosoted chestnut, cut from the Forest by CCC labor.

Finally the CCC program ended and funds for the employment of telephone technicians and maintenance men were eliminated. We awoke to a considerable maintenance job, with only the "ground squirrel" type of linesman to do this job.

The job fell to the ranger and assistants. Many splinters were extracted from various parts of anatomy in the process of learning the simple art of climbing. Finally the personnel became sufficiently skilled to get up the shorter poles and do some of the maintenance, but there still remained a lack of technical skill for the more complicated maintenance jobs. Unskilled maintenance, combined with gradually rotting chestnut poles, finally brought an ever-increasing maintenance job, with decreasing line efficiency. And the R.E.A. began to parallel our lines, with the result some were almost useless from inductive interference.

The excessive amount of work and cost of maintaining the system for only a few phones soon made us think about turning our troubles over to someone else. Some of the lines ran through rather heavily populated rural areas, where we had considerable pressure for telephone service. These people finally applied their pressure to the local commercial company, with the result that we were first able to lease one line to the company, with provisions for lookout tower and warden service. Next, the completion of Wolf Creek Dam by the U.S. Engineers and the resulting inundation of parts of the Cumberland River and its upper tributaries, made it necessary that we either raise our lines across the water or abandon the telephone service to part of the district and an adjoining district. We decided that we would abandon the service and use the money provided by the U.S. Engineers, for the installation of radios to serve the broken communication links.

The leasing of one line and the installation of radios cut out enough phones to permit us to combine some lines. The resulting combination made it possible for us to abandon the Forest Service switchboard; the local company could handle the necessary switching service.

During the past year another main line, together with several spur lines, was sold to the local company. Two circuits have been salvaged. One grounded warden circuit has been abandoned and remains to be salvaged or sold. Another trunk line to an adjoining district, now served by radio, remains to be sold or salvaged.

Soon our only remaining telephone line will be a 2-mile, grounded, tree-line circuit between one tower and a warden. Radios and phones on commercial service will afford adequate communications at a considerable saving.

Comparative costs are as follows for maintenance, trouble shooting, and rentals:

Old system:	
Ranger and subranger time, 350 hours	$975
Transportation; trucks and pickup, 1,500 miles	140
Regular season lookout labor, 80 hours	120
Other labor	200
Poles and maintenance materials	250
Switchboard operation	562
Pin rentals	431
Total annual cost	$2,678
New system:	
Telephones, commercial, 6	288
Radio maintenance technician, time and travel, 5 radios	225
Radio maintenance, local shops	40
Radio batteries	40
Radio parts	30
Local personnel, checking batteries, etc.	60
Maintenance of spur warden telephone circuit	22
Increase in toll calls	50
Total annual cost	$755

The new setup will save money and at the same time increase the time available for other important assignments on the district. It has already permitted the increase of our annual timber cut by one-half million board-feet. Better radio communication has increased the efficiency of fire suppression.

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Of Birds, Snakes, and Forest Fires

The timber cutting crew on the Flat Top Experimental Forest near Birmingham, Ala., recently spotted smoke rising from a small fire and went to investigate. They found the fire spreading from a powerline right-of-way. After the ground blaze was controlled, they noticed that sparks and burning embers were dropping from a crossarm on a utility pole.

Closer examination revealed the cause of the fire. A woodpecker had hollowed out a hole near the top of the pole, built a nest, and started a brood of young birds. A large chicken snake had climbed the pole, discovered the young birds, and proceeded to devour one of them. While or after doing so, the snake stretched out on the crossarm. Apparently his body came in contact with two wires at the same time. The resulting electric shock killed him and produced a spark that set fire to the crossarm, which was partly rotten and tinder-dry. Burning fragments dropping from the crossarm had set fire to the litter on the ground.—HERBERT A. YOCOM, *Southern Forest Experiment Station, U. S. Forest Service.*

HANDTOOL CONTROL LINES, A NEED ON FOREST FIRES

C. F. RITTER

Fire Staffman, Gifford Pinchot National Forest

We are living in a machine age, and the fact that machines have stepped up the control time on the majority of project fires is old stuff. However, the fact that a majority of foresters in the Northwest are falling in line with loggers in their belief that fires cannot be controlled without machines is alarming. Let us not forget the old horse-and-buggy days and the flying 40; a lot of fires were rounded up and mopped up long before bulldozers came into use.

Sure, we want to get machines on those fires where their use is practical. This is especially true when fuels are dry, the fire is running, and burning out between the machine line and the oncoming fire is no problem. The first thought of machine-minded foresters and loggers when a fire starts is: "get some cats on the job." In at last 50 percent of the cases, this is smart thinking. But let us take a look from a different viewpoint. Let's give each fire that starts, the old quick analysis—location, fuels, topography, and weather.

Location tells one where the fire is and how long it will take to get men and/or machines on the job. Fuels, weather, and topography indicate what is burning, how it is burning, and where the fire is likely to go. Topography also indicates whether or not the use of machines is practical. If a fire is burning where machines can be used to advantage and good machines can be placed on the fire within a period of time comparable to the time that men can be moved in, machines should be used. But where men are on the fire already or can be there in half the time or less than it would take to get machines, let us organize handtool crews, get a line around the fire, and burn out.

There are a lot of fires where both machines and handtools should be used. For instance, the following situation is not infrequent. The fuel moisture content is low and machines are working on ridges or otherwise well in advance of the fire on the basis of planned burning out; suddenly the fuel moisture goes up, the fire stops its run, burning-out fires stop and the actual fire area is inaccessible to machines. Here is a need for handtool crews. Stop setting fires, get hand crews on the fire edge, cold trail, or build a narrow line and force burning-out fires.

Too many factors are involved to say offhand just where and when to use machines and where not to use them. However, machines sometimes do more damage than good. We have all been

on fires where a half dozen men with handtools could have run a line around the fire in a very few minutes, but a tractor was used. The handtool crew would have controlled the fire in 30 minutes and completed mopup in another hour, but the machine came plowing in, tore up the landscape, piled dirt and debris on the fire which took days to dig out, pushed unburned logs into the fire, knocked down trees and snags, all of which had to burn out before mopup could be started.

Another example is where a fire has settled down after making its run, and the fire boss has a few hours' grace before weather conditions become critical again. The fire is quiet and the headman wants to "nip her in the bud." Again, the RD-8 comes in knocking down timber and stacking up debris that will take a week, and a dangerous week, to burn out. Use of machines entails more and difficult mopup. Use of machines retards mopup.

The location of lines, machine or handtool, is or should be largely dependent on weather conditions. The only justification for leaving the fire edge is when conditions are such that men and machines are forced back in order to give them time to construct control lines and burn out before the fire reaches them. Wide control lines give a false feeling of security even though there are acres of unburned fuels inside. A narrow line well burned out is actually much more dependable.

Both State and Federal protective agencies require industrial operators to make handtools available to their crews, but apparently little thought has been given to whether these tools are ever used when fires start, or whether anyone in the crews knows how to use them. Present-day woods-industrial personnel are not all experienced fire fighters. Uusually the only organized and trained fire fighters available to protective agencies are those that they themselves organize and train. These crews are very much worthwhile. They know how to control and mopup fires. In other words, they use handtools where handtools should be used. They get on the fire quickly and stay on the fire edge until it is out.

Caution and versatility are essential attributes in fire control men. A successful fire manager necessarily has to be on his toes in order to recognize conditions as they may be at any given time, and as they may be 4 hours hence; and that same man should be capable of changing control tactics to conform with changing conditions. It is his responsibility to determine when to use machines as well as the time and place to use handtools. There is definitely a place for both.

ROADSIDE FIRE PREVENTION POSTERS

DON M. DRUMMOND

Nevada Assistant State Firewarden

Charles Swanson, Nevada State Fire Control Assistant, needed some fire prevention posters that could and would be noticed and read by motorists as they drive along the highways at 65 miles an hour. Waldo J. Van Arsdale, Toiyabe National Forest Fire Dispatcher, had some ideas on how to build a simple, sturdy roadside sign with a pleasing appearance. The State Forest Fire Protection Fund had a little money budgeted for such a prevention project.

"Pressdply"—plywood with pressed wood product glued to each surface—is used for the sign panel. A commercial sign company, using the Smokey that appeared on News Week magazine in the summer of 1952, painted the posters (fig. 1).

FIGURE 1.—The Smokey roadside poster as it appears on U. S. 50, 12 miles east of Lake Tahoe, Nev.

Two redwood sawed posts, 8 by 8 inches by 12 feet, are used as uprights. One post is routed to accommodate one end of the sign, the other is supplied with a removable plate (fig. 2). Screws through the posts and "Pressdply" minimize vibration caused by

wind. One inch below the lower edge of the sign panel, a half-inch iron rod passes from the outside of one post to the outside of the other. This rod is threaded at both ends to allow it to be tightened to hold the sign secure. A section of iron U-trough welded to the middle of the rod, and fitting snugly over a section of the lower center edge of the sign helps, too, to hold the sign against wind vibration.

A strip of metal linoleum counter edging placed along the top edge of the sign protects the plywood from rain and weather.

FIGURE 2.

When the fire season is over, by removing the iron rod and the screws holding the panel, the sign may be taken out and stored for use during the next fire season. Eventually we hope to have enough panels to allow them to be exchanged as the season progresses.

RATE OF SPREAD ON A WASHINGTON FERN FIRE

WILLIAM G. MORRIS

Forester, Pacific Northwest Forest and Range Experiment Station

Rate of spread, fuel moisture, and climatic conditions were measured on the 4,000-acre Livingston Mountain fire east of Vancouver, Wash., on April 11 and 12, 1951. In behavior, this fire typified many early spring fires on cut-over areas in the foothill zone of the Douglas-fir region. Some of the measurements of rate of spread will be given as an example of this type of fire.

The fire burned across a gentle to moderate south-facing slope that extended some 3 miles from level farmland to the top of a broad hill, 1,500 feet higher. At the steepest points, the slope was about 40 percent.

As in much of the foothill country, ground cover was mostly western bracken fern intermingled with annual weeds, trailing blackberry, and salal, an evergreen shrub 6 to 15 inches high. In this locality, bracken grows to a height of 2-1/2 feet and forms a dense ground over. In April, however, the dead crowns are bent to the ground and form a loose, flashy fuel about 1 foot deep. Hazel brush, about 8 feet tall and not yet in leaf, formed a sparse overstory. Here and there pole-size Douglas-fir had survived previous fires and occurred in large blocks, small patches, or as single trees. Scattered Douglas-fir seedlings and saplings were also present in some areas of bracken and brush.

The weather was unusually favorable for fires. The preceding 10 days had been clear and unseasonably warm with dry winds. Before this period, rainfall had been normal. On April 11 the relative humidity fell to 14 percent, and wind speed measured with a portable anemometer 6 feet above the ground was consistently 18 to 20 miles per hour. Moisture content of dead bracken fuel was 9 percent or less even though the soil was still moist 1/4 inch below the surface.

Lineal spread and contributing factors were measured on heads and flanks of the sprawling, irregular fire. Measurements were taken mostly during short periods when wind speed, direction of spread, topography, and fuels were fairly uniform. Spread was usually measured for a distance of 50 feet or less although occasionally for 0.1 to 0.5 mile. On April 11, when the wind speed was 18 to 20 miles per hour and the relative humidity was 16 percent, rates of spread beyond the shelter of trees varied from 660 feet per hour to 7,900 feet per hour (table 1). On April 12, when the wind speed was 7 to 8 miles per hour and the relative humidity was 26 percent, rates of spread varied from 80 feet per hour to about 1,600 feet per hour (table 2).

On April 11 the fire spread so rapidly that control through flank attack would have required construction of control line at a rate of more than 1/2 mile per hour along both flanks. During short periods when flames rose in the crowns of scattered conifers and embers flew far ahead, more than 1-1/2 miles of control line would have to be constructed per hour. In flash fuel of this kind,

a frontal attack with a slower rate of line construction could be effectively used to check the head of the fire.

Although effects of wind speed and relative humidity cannot be separated in these observations, rate of spread apparently in-

TABLE 1.—*Rates of spread and contributing factors measured on a Washington fern fire April 11, 1951 (Wind, east 18-20 miles per hour; relative humidity, 16 percent; temperature, 71°–75° F.)*

Rate of lineal spread (ft. per hr.)	Position on fire	Direction of spread with reference to slope	Slope[1] (percent)	Remarks
7,900	Head		0	Crowns of scattered conifers afire. Spotted ahead. Measured on 0.1 mile spread.
3,300	do		0	No spotting.
2,400	Flank	Down	15	Spread only 350 feet per hour while flames drew inward just previous to this measurement. Drafts then became turbulent and flames surged outward.
2,400	Head		0	
2,400	do	Down	25	Some spotting. Measured on 0.3 mile spread.
2,100	do		0	Some spotting. Measured on 0.5 mile spread.
1,320	Flank	Down	15	
1,320	Head		0	Flames 6-8 feet high and intermittently drew outward or inward.
1,320	do	Down	10	Measured on 0.5 mile spread.
1,000	do		0	
800	Flank		0	
660	do		0	
400	Head		0	In dense stand of Douglas-fir 50 feet tall. Wind at treetops about 20 miles per hour, and at 6 feet above ground, 4 miles per hour. Fire spread in twig litter 2-3 inches deep and produced a blazing border 4 feet wide in which flames were vertical and less than 2 feet high.
100	do		0	Same stand and wind as above. Flames drew inward toward fire and formed a border only 1 foot wide.

[1] South aspect.

TABLE 2.—*Rates of spread and contributing factors measured on a Washington fern fire April 12, 1951 (Wind, west 7-8 miles per hour; relative humidity, 26 percent; temperature, 77° F.)*

Rate of lineal spread (ft. per hr.)	Position on fire	Direction of spread with reference to slope	Slope [1] (percent)	Remarks
1,580	Head	Up	5	Spread at right angles to overhead wind. The flames, 1-3 feet in height, drew outward although just previous to this measurement they drew inward.
990	do		0	
730	do		0	
630	do	Down	10(E)	
530	do		0	Flames 1-3 feet high in strip 2 feet wide drew inward.
500	do	Down	10(E)	
360	do		0	
340	Flank		0	
280	Head	Down	10(E)	
200	do	Up	5	Spread at right angles to overhead wind.
150	do	Up	5	Spread at right angles to overhead wind. Flames drew inward.
130	Rear		0	Bracken flattened to 3-inch layer.
120	Head	Up	5	Spread at right angles to overhead wind. Flames drew inward.
110	Flank	Up	5	
80	Head	Up	5	Do.

[1] South aspect except for 3 observations indicated by "E" which were on east aspects.

creased 4 to 5 times when wind speed increased 2-1/2 times and was accompanied by an appreciable drop in relative humidity. Measurements on many other fires show that a lineal spread of 400 to 900 feet per hour, as recorded in table 2, is typical of fires in brush, bracken, and weed cover on nearly level ground in the Pacific Northwest. Spread is of course greater on steep slopes. In the litter of the normally dense coniferous forests, rate of spread is a small fraction of that shown in table 2. In the unburned logging slash of these forests, rate of spread is greater than shown in table 2 owing to large numbers of wind borne embers that set new fires far in advance of the surface fire.

FUEL-MOISTURE FORECASTS

FRANK C. HOOD

Meteorologist, U. S. Weather Bureau Fire Weather District 8, Asheville, N. C.

The moisture content of the upper layers of forest fuels, such as hardwood leaves and pine needles, is one of the most important elements determining the flammability of such fuels. A reliable index of this moisture content is given by the fuel-moisture indicator sticks used in the fire-danger measurement system described in Agriculture Handbook 1, Forest Fire-Danger Measurement in the Eastern United States, by G. M. Jemison, A. W. Lindenmuth, and J. J. Keetch.

If it were possible to predict the moisture content of the indicator sticks in advance, then an effective component of fire danger would be known in advance. As far as the writer knows, the first attempt to predict the moisture content of the indicator sticks was started almost simultaneously in 1947 by both the Bureau's Asheville and Boston Fire Weather Forecast Centers.

By using as a basic guide the results of studies of the Southeastern Forest Experiment Station relating to fuel moisture, relative humidity, fuel temperature, and solar radiation, the writer developed tables 1 and 2.

Table 1 shows the determined relationship between stick and dew-point temperatures. Table 2 gives certain adjustments that have to be made for the influence of predicted meteorological elements, and shading produced by vegetative conditions and aspect on stick temperatures. Throughout the study, the Fire Control Investigations Unit of the Southeastern Forest Experiment Station and J. J. Keetch rendered valuable assistance in the development of the tables. Keetch also field-tested the results expressed in table 1 before it was put in use. These tests indicated that best predictions could be made when fuel moistures reflected by the indicator sticks were 10 percent or lower, and unsatisfactory results could be expected during periods immediately following a rain.

Following is an example of how tables 1 and 2 are used. Assume a cured condition of the lesser vegetation, and that, as determined from weather charts, the weather tomorrow afternoon will be clear, the air temperature 66° F., the dew point 25°, and the wind velocity (8 feet above ground in average forest cover) 4 miles per hour. From table 2 it will be seen that with a wind velocity of 4 m. p. h. under clear conditions, 12° must be added to the air temperature to obtain a value for stick temperature (66° + 12° = 78°). Referring to table 1, a stick temperature of 78° and a dew-point temperature of 25° gives a predicted fuel moisture of 5.5 percent.

To test the accuracy of the fuel-moisture forecasts made 24 hours in advance of actual occurrence, the forecasts by 2 forecasters during April 1952 for 10 scattered districts out of the 100 for which forecasts are prepared, were checked against the ob-

TABLE 1.—*Indicated average moisture content* [1] *of basswood fuel-moisture sticks in relation to temperature on sticks and dew-point temperature*

Temperature on sticks (°F.)	Dew-Point Temperature of—						
	5-14°F.	15-24°F.	25-34°F.	35-44°F.	45-54°F.	55-64°F.	65-74°F.
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
125-134	1.5	1.5	1.5	1.5	2.0	2.0	2.0
115-124	2.0	2.0	2.0	2.0	2.5	2.5	2.5
105-114	2.5	2.5	2.5	2.5	3.0	3.0	3.0
95-104	3.0	3.0	3.0	3.0	3.5	3.5	4.0
90-94	3.5	3.5	3.5	3.5	4.0	4.5	5.0
85-89	4.0	4.0	4.0	4.5	4.5	5.5	6.5
80-84	4.5	4.5	4.5	5.0	5.5	6.5	8.0
75-79	5.0	5.0	5.5	5.5	6.5	7.5	10.0
70-74	5.5	5.5	6.0	6.5	7.5	9.0	14.0
65-69	6.0	6.0	6.5	7.5	8.5	11.0	15+
60-64	6.5	7.0	7.5	8.5	10.0	14.0	15+
55-59	7.0	7.5	8.5	9.5	12.5	15+	15+
50-54	7.5	8.5	9.5	11.5	15+	15+	15+
45-49	8.5	9.5	11.0	13.5	15+	15+	15+
40-44	9.5	11.0	13.0	15+	15+	15+	15+
35-39	10.5	12.0	15+	15+	15+	15+	15+
30-34	12.0	13.5	15+	15+	15+	15+	15+
25-29	13.0	15+	15+	15+	15+	15+	15+
20-24	15	15+	15+	15+	15+	15+	15+

[1] Moisture percents indicated are for cured and transition vegetative conditions.

served fuel moistures at fire-danger stations located within the districts (table 3). This particular month was selected from a number of verification studies, because it represented a period during which forecasting problems were more numerous than normal.

Observed fuel moistures and the predicted moisture values during shower-type rain periods were not tabulated when showers were forecast and occurred as expected. The reason for this omission is that showers usually are not expected to produce a general rain over an entire control district. Therefore when showers are indicated, the showers are mentioned in the forecasts, but the estimated fuel moistures given are for the areas not receiving the rain. Within the month of April there were 40 such instances at the sampling stations. Fuel moistures remained below 10 percent on 13 of these occasions; otherwise they were 15+ percent, indicating the uneven distribution of effective precipitation when showers occur.

Further, the statement in an earlier paragraph relative to results obtained through the use of the tables during periods immediately following a rain is borne out by the large number of unsatisfactory forecasts concentrated in the 15+ percent line in table 3. These will be reduced if experiments confirm our observations on the elapsed time required for the sticks to lose the bulk of their moisture when the weather returns to fair.

TABLE 2.—*Temperature adjustments for certain predicted meteorological elements and shading, to be used in conjunction with fuel-moisture-prediction table 1* [1]

Wind [2] (m. p. h.)	Clear	Overcast—thin, high clouds	Broken cloudiness—partly cloudy	Overcast—thin middle or low clouds	Overcast—thick [3]
	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
Calm	20	18	12	6	0
2	18	16	11	5	0
4	12	11	7	3	0
6	9	8	5	3	0
8	6	5	4	3	0
10-12	5	4	4	2	0
14 or over .	4	4	3	1	0

[1] To obtain temperature on sticks (table 1), add temperature shown here to air temperature forecast for time fuel-moisture value is required, considering also other forecast weather conditions. These values are for cured and transition vegetative conditions unless otherwise specified.

[2] Wind velocities in m. p. h. 8 feet above ground in average woods cover.

[3] Temperatures listed apply also to green vegetative condition, or shaded north slopes, or night time.

TABLE 3.—*Comparison between observed and predicted fuel moistures at 10 widely scattered districts in Fire Weather District 8, April 1952*

Observed fuel moisture (percent)	Number of forecasts	Difference between observed and predicted fuel moistures of —												
		0 Pct.	±1 Pct.	±2 Pct.	±3 Pct.	±4 Pct.	±5 Pct.	±6 Pct.	±7 Pct.	±8 Pct.	±9 Pct.	±10 Pct.	±11 Pct.	±12 Pct.
1	0													
2	10		6	2	1	1								
3	31	15	9	3	3	1								
4	37	15	16	4	1	1								
5	32	10	9	12	1									
6	15	6	6	3										
7	6		2	3	1									
8	4	1			3									
9	5			1	4									
10	5	1					4							
11	3				1		1	1						
12	0													
13	0													
14	0													
15+	29	1			1		2	1	4	6	8	2	2	2
Total	177	49	48	28	16	3	7	2	4	6	8	2	2	2

These tables can be used to compute burning indexes in areas where there are first order weather stations but no fire-danger stations. There is another application of the tables which may be of considerable importance from a research standpoint. By using data from Weather Bureau stations, it would be possible to compute burning indexes for severe burning periods in the past for which fire-danger data are not available.

☆ ☆ ☆

Blasting Technique

On stump-wood operations within the forest it is common practice after bulldozing stumps to break them up with a charge of dynamite to facilitate loading. A hole is bored in the stump by an auger, and a stick of dynamite placed in the hole. During the winter of 1952, one such operation on the forest caused no less than five forest fires while no fires resulted from similar operations with other crews.

An extensive check was made to determine the cause of the high rate of fire occurrence. The investigator discovered that the blasting crew's technique was not standard. Instead of crimping the cap on the fuse with a standard crimper, the crew was fraying the end of the fuse and twisting the frayed ends around the cap in such a way that it would hold temporarily. When the charge went off, a wad of the frayed end of the fuse would be blown out the hole in the stump. Quite often the wad of material would be smoldering. The smoldering wad, combined with dry grass and a little wind, provided ideal conditions for starting fires. Areas being stumped usually support an abundance of dry grass, which makes it difficult for stumping crews to extinguish small fires once they start. After using the crimper no more fires were started by this particular operation.—McClain Smith, *Ranger, Kisatchie National Forest.*

☆ ☆ ☆

Hose Mildew Proofers Tested

The National Research Council has investigated the stability, in water, of mildew proofing materials—in particular their resistance to leaching—and has issued a limited distribution report of its findings. Six commercial preparations in varying concentrations were tested by subjecting treated, unlined, linen hose sections to leaching tests for periods up to 60 days; and then making soil burial tests.

Of the preparations tested, the copper compounds were the only ones to withstand leaching satisfactorily, in particular, Copper-8-hydroxy-quinolinolate. Though the latter is comparatively expensive, the cost of treatment for adequate protection against mildew is no more than if less expensive materials were used, because of the small amount needed per unit length of hose. Furthermore, because of the small amount of Copper-8 compound required, its use does not cause stiffness or otherwise adversely affect hose characteristics.

The study discovered that hose left in water at moderate temperatures for even a few days showed substantial loss in strength owing to the action of organisms present in the water. This fact had not been recognized previously.—(Report of Forest Fire Committee of the Canadian Institute of Forestry, reported in *The Forestry Chronicle Supplement*, March 1953.) From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 4: 67. 1953.

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double spaced, and with no paragraphs breaking over to the next page.

The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and mail.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptable. Legends for illustrations should be typed in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend being separated from the text by lines both above and below. Illustrations should be labeled "figures" and numbered consecutively. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illustrations should be placed between cardboards held together with rubber bands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustrations. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired.

India ink line drawings will reproduce properly, but no prints (blackline prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.

Dangerous Moment!

Remember– Only YOU can

PREVENT FOREST FIRES!

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Dangerous Moment!

At this moment, a beautiful, green forest can be saved or destroyed.

If you *think*, the cigarette will be snuffed out safely. If you do *not* think, another terrifying forest fire may well be on its way.

Last year, just such careless moments started approximately 190,000 forest fires. They destroyed enough timber to build all the houses in a city of a half million population. They cost America and *you* well over *one billion dollars!*

So won't you please be extra careful this year? Be careful with cigarettes, matches, campfires, *any* fire. Nine out of ten forest fires are caused by people—people like *you*.

Remember—**Only <u>you</u> can**

PREVENT FOREST FIRES!